PIPE EXPLORERTM USES

The Pipe ExplorerTM system has been used for alpha, beta, gamma, and video surveys of over 6,000 Two fully automated and two feet of piping. manually operated Pipe ExplorerTM deployment systems have been used to conduct these surveys (Figure 3 shows one of the automated systems in use). The surveys have included pipes with up to 8 elbows and with vertical runs in excess of 9 m. Detectors have been successfully deployed past rocks, oil, and other debris that have obstructed up to 50 percent of the pipe's cross sectional area. The Pipe ExplorerTM deployment systems are capable of conducting surveys in pipes with diameters ranging from 0.05 m (2-inches) to 1.22 m (48-inches) and survey lengths that vary from 30 m up to 300 m. The following is a chronological listing of those uses of the system. A summary of the type of surveys completed and the outcome that resulted from the use of the Pipe ExplorerTM data are discussed.



Figure 3. One of the automated Pipe ExplorerTM systems being used to conduct radiological surveys through a floor drain at a DOE site.

 A. Idaho National Environmental Engineering Laboratory Idaho – July 1994

A feasibility demonstration of the Pipe ExplorerTM system was conducted at the INEEL Chemical Processing Plant. A gamma detector was

used to survey scrap piping ranging from 0.05 m (2-inches) to 0.10 m (4-inches) in diameter. In addition a mock drain line system consisting of 3-inch steel piping was surveyed to detect Cs-137 sources placed in the piping. This use of the system served as a feasibility demonstration only.

 B. DOE Formerly Utilized Sites Remedial Action Program General Motors Site Michigan – April 1995

Beta/gamma surveys were conducted in an oil drainage system to determine the location and extent The drainage system of U-238 contamination. consisted of a network of 0.1 m (4-inch) diameter pipes running underneath the concrete slab of an operational automobile parts factory. The survey data obtained with the Pipe ExplorerTM system was used to determine if piping needed to be cleaned. The Pipe ExplorerTM was also used after cleaning activities to verify the effectiveness of the process. The Pipe ExplorerTM data allowed the site remediation contractor to grout the pipes and leave them in place instead of excavating and disposing of the pipe as radioactive waste. Subsequently, over \$2 million in remediation costs were avoided. The performance of the Pipe ExplorerTM system was published in a DOE Technology Summary Report¹.

A noteworthy aspect of the use of the Pipe ExplorerTM system at this site was that the quality of the data was highly dependent on the inherently clean operating method of the system. The drain lines being surveyed were heavily coated with a thick oily sludge that contained the U-238 contamination. Since the Pipe ExplorerTM membranes are inverted upon retrieval, the contamination is always kept inside the polyethylene membrane material (Figure 4 shows one of the membranes after it had been retrieved from a drain line at the site). Therefore, the Pipe ExplorerTM membrane protected the detectors used at this site from coming into contact with the oil. This ensured that true surface activity measurements as a function of distance were obtained, which was critical for performing the site hazard assessment². Furthermore, none of the equipment became contaminated, which allowed for the system to be moved from one drain line to the next without fear of spreading the U-238 contamination. If a detector had been inserted into the pipe with either a robotic device or a direct push method then this would not have been true.



Figure 4. Photograph of a Pipe ExplorerTM membrane retrieved after surveying a pipe containing oil and U-238 contamination. Note how the contamination is contained within the membrane.

C. Inhalation Toxicology Research Institute New Mexico – November 1995

The Pipe ExplorerTM system was used to conduct both gamma and beta/gamma surveys in 0.10-m (4-inch) and 0.15-m (6-inch) diameter pipelines buried beneath the concrete slab of an operational laboratory. The contaminants of concern were Cs-137 and Sr-90. In addition, video surveys were conducted to determine the integrity of the decades old piping system. The Pipe ExplorerTM data showed that the majority of the piping was clean enough to avoid extensive remediation costs. Furthermore, the video data showed that the pipes were in good enough physical condition so that they could continue to be used as part of the site sewer system.

D. DOE-Grand Junction Projects Office Colorado – February 1996

Buried drain lines were surveyed using the Pipe ExplorerTM beta/gamma detector to determine U-238 contamination levels. In addition, video surveys were conducted to determine the physical condition of the piping. The pipes surveyed ranged from 0.076 m (3-inches) to 0.20 m (8-inches) in diameter. As a result of the Pipe ExplorerTM surveys, much of the piping will be allowed to be left in place. Estimated cost savings are on the order of \$1,000,0000.

An example of the data obtained from the GJPO site is shown in Figure 5. A video survey conducted

in this same section of pipe showed that each contamination spike corresponded with a location where debris had built up under vertical risers coming from drains in a laboratory.

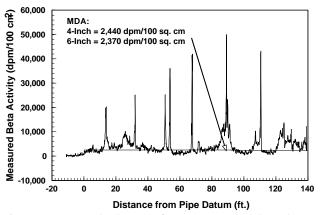


Figure 5. Example data set from surveys conducted at the GJPO site showing localized elevations in surface activity.

E. Argonne National Laboratory, CP-5 Reactor Illinois – August 1996

This use of the Pipe ExplorerTM system was conducted as part of the Argonne National Laboratory - CP-5 Large Scale Demonstration Video and gross gamma surveys were conducted in a 0.1-m (4-inch) diameter exterior drain line. In addition, the Alpha ExplorerTM system was used to conduct alpha surveys in concrete embedded fuel rod storage tubes. The performance of the system along with a detailed cost benefit analysis were documented in a DOE Technology Summary Report³. The cost benefit analysis compares the Pipe ExplorerTM survey costs to the baseline costs of removing and disposing of piping as contaminated waste. The analysis shows that it becomes cost effective to use the Pipe ExplorerTM if more than 25m of piping is involved and the cost savings increase as more piping is included. For instance, if 120 m of piping is surveyed instead of excavated, then the use of the Pipe ExplorerTM is a factor of 3 more cost effective than the baseline.

F. DOE Mound Facility Ohio – November 1996

The Pipe ExplorerTM system was used to survey buried radioactive waste drain lines. Gross gamma surveys and periodic spectral measurements were taken to determine the extent of Co-60 contamination in 0.13-m (5-inch) and 0.20-m (8-inch) diameter pipes. In addition, video inspections were conducted. This use of the system represented a case where no cost savings were realized. Contamination above acceptable levels was found and it was determined that the piping could not be cleaned in place. Subsequently, no remediation costs were avoided.

G. Crystal River Nuclear Plant Florida – October 1997

An inspection of a gate valve in the feed water line of the power plant showed that a hinge pin and a retaining pin had detached from the valve and the parts had been washed downstream in the pipe. Therefore, the Pipe ExplorerTM system was used to conduct a video inspection of the 0.46-m (18-inch) diameter pipe to try and locate the objects. A video survey was conducted in the line that included 8 elbows and a 9.4-m vertical rise. The video survey showed that the parts were not located in that portion of the feed water system.

H. Trojan Nuclear Plant Oregon – November 1997

The Pipe Explorer system was used to conduct gross gamma surveys of 0.10-m (4-inch) diameter drain lines embedded in concrete. The primary contaminant of concern was Co-60. The system was used to measure surface activity both before and after high-pressure water was used to clean the pipes. This project served as a trial run to determine the cleaning and survey methods to use for full-scale remediation of drain lines in the plant.